

**ABSTRACT**

A method of fabricating a waveguide in ferroelectric crystals, comprising the following steps. A ferroelectric crystal is provided. A vapor phase proton is diffused into the ferroelectric crystal by a vapor proton-exchange process to form a vapor proton-exchange (VPE) waveguide material structure having a step refractive index profile. The VPE waveguide material structure is treated with one or more processes selected from the group consisting of: a post thermal anneal process and an additional reverse proton-exchange process to complete fabrication of the waveguide, whereby the refractive index profile of the fabricated waveguide can be flexibly optimized. This method can form a high-quality waveguide and also provides a full degree of design flexibility for device optimization in several applications.